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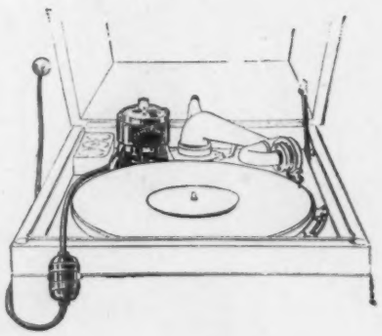

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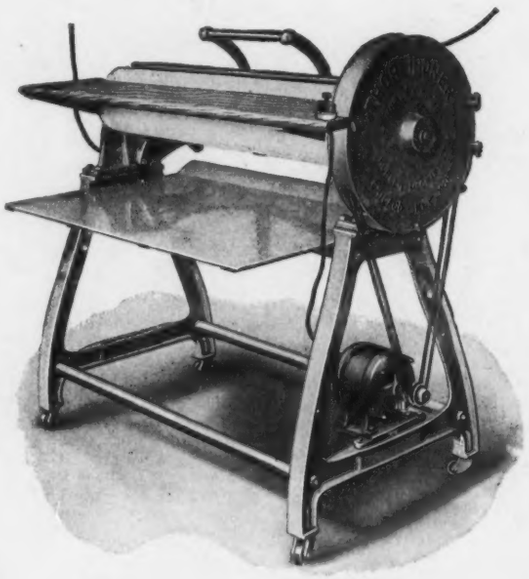

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JOURNAL OF ELECTRICITY
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VOLUME XXXVII SAN FRANCISCO, SEPTEMBER 30, 1916 NUMBER 14

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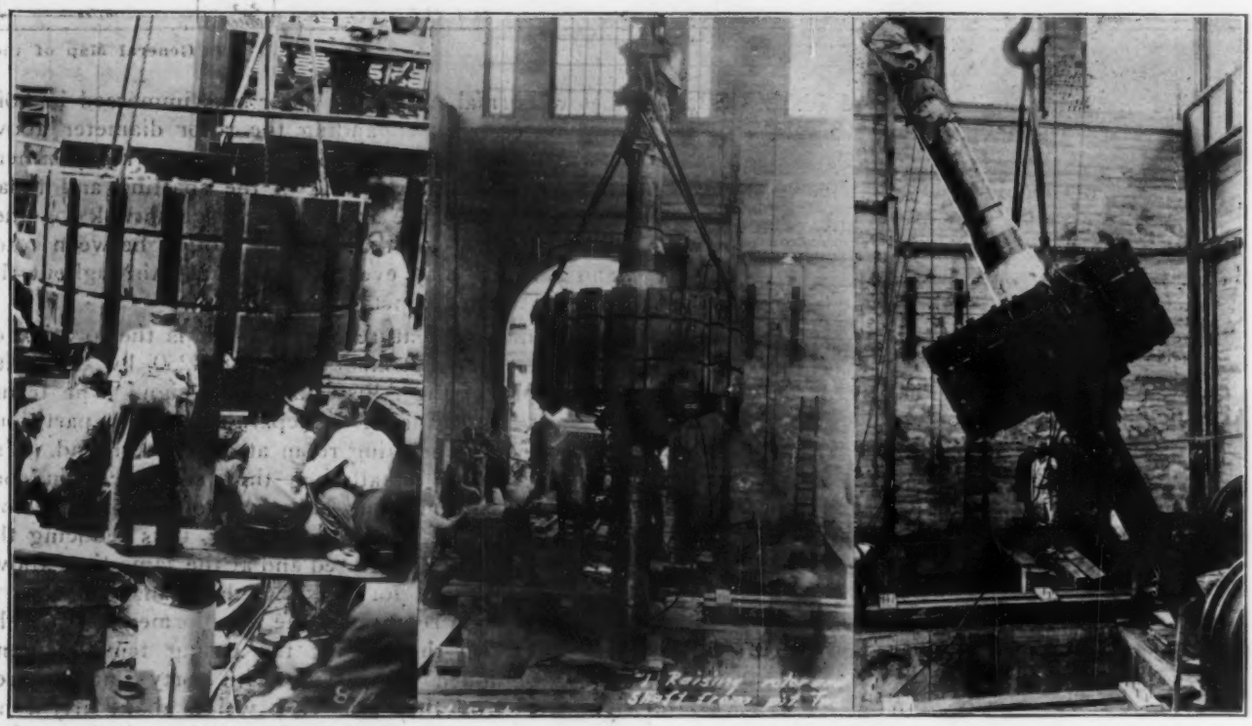
THE HALSEY AND WISE POWER PLANTS

BY ROBERT SIBLEY.

In the heart of the snow-capped Sierras about one hundred sixty miles northeast of San Francisco and twenty-three miles below Summit, California, is an artificial reservoir known as Lake Spaulding. This reservoir conserves the flood waters of a vast region and will act as a main artery in feeding some six or seven hydroelectric power plants when the Lake Spaulding Development is completed. After the water has spent itself in thus driving the wheels of industry, it is to be finally used in irrigating the fertile farms in the Sacramento Valley.

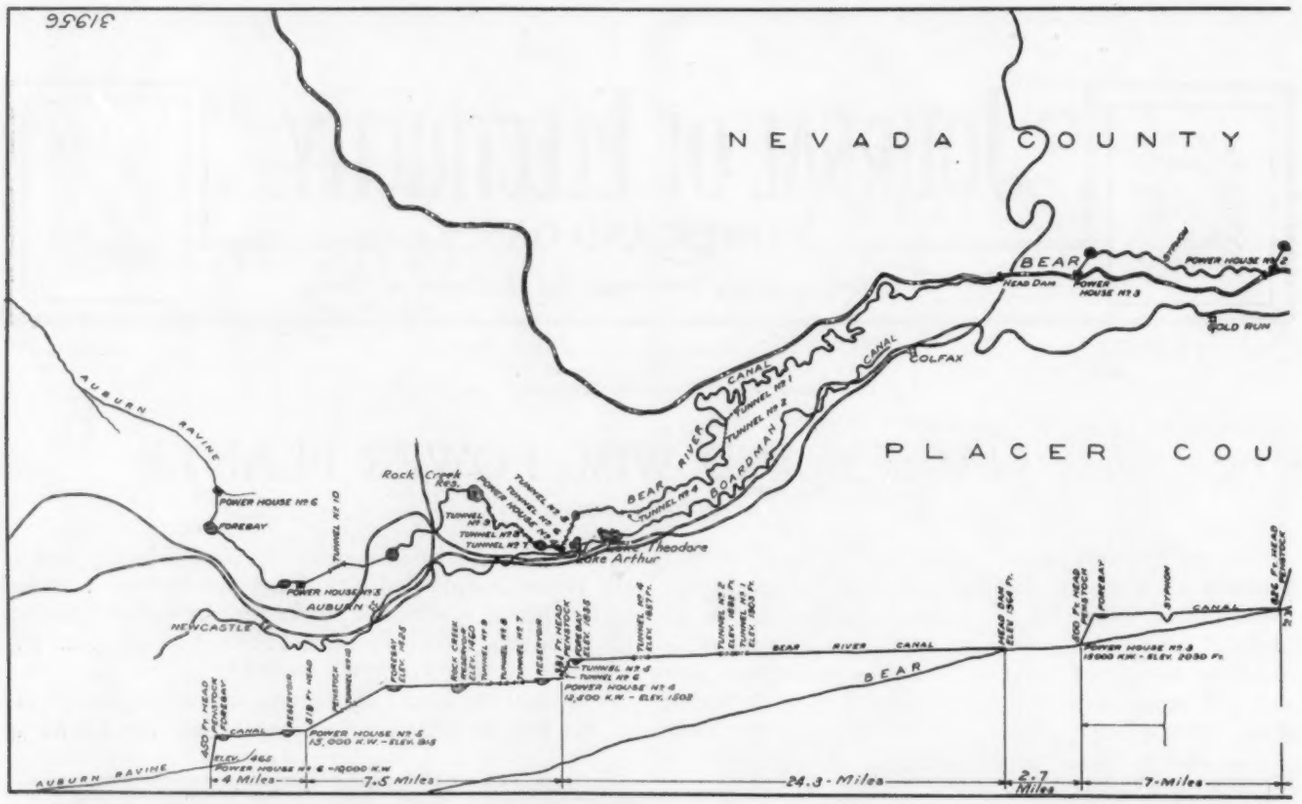
The Spaulding dam, when finally completed will rise 305 ft. above the gorge upon which it rests and will thus create the deepest artificially impounded waters in the world. Of the six or seven proposed power plants, one is now in operation, being that of the Drum installation completed just in time to assist in furnishing additional power for the wonderful electrical effects of the Panama-Pacific International Exposition at San Francisco in 1915.

Within the next two months, two additional power plants will be put into service. These are shown as Nos. 4 and 5 on the map accompanying this article, and are to be known as the Halsey and Wise Power Plants, respectively. The remaining plants will be installed as rapidly as the growing service of the company will demand their use, which, due to the increasing cost of fuel oil and consequent slackening in development of steam power, will not be far in the future. It is the purpose of this article to describe the



The Shrinking of a Fifty-Five Ton Rotor and Shafting at the Halsey Plant.

(In the first view the huge rotor is being lowered upon the shafting, in the second view the shrinking has been accomplished, while in the third view the rotor and shafting are being lowered into their horizontal position for permanent installation. Note how small the attendant looks in this last picture.)



General Map of the

features of construction encountered in the installation of the Halsey and Wise power plants, leaving a description of the canals and penstocks of these plants for the subject matter of a later article.

The Halsey Power Plant.

By reference to the map it may be seen that water from the Bear River Canal is conveyed through tunnel and penstock to Power House No. 4 which is to be known as the Halsey Power Plant.

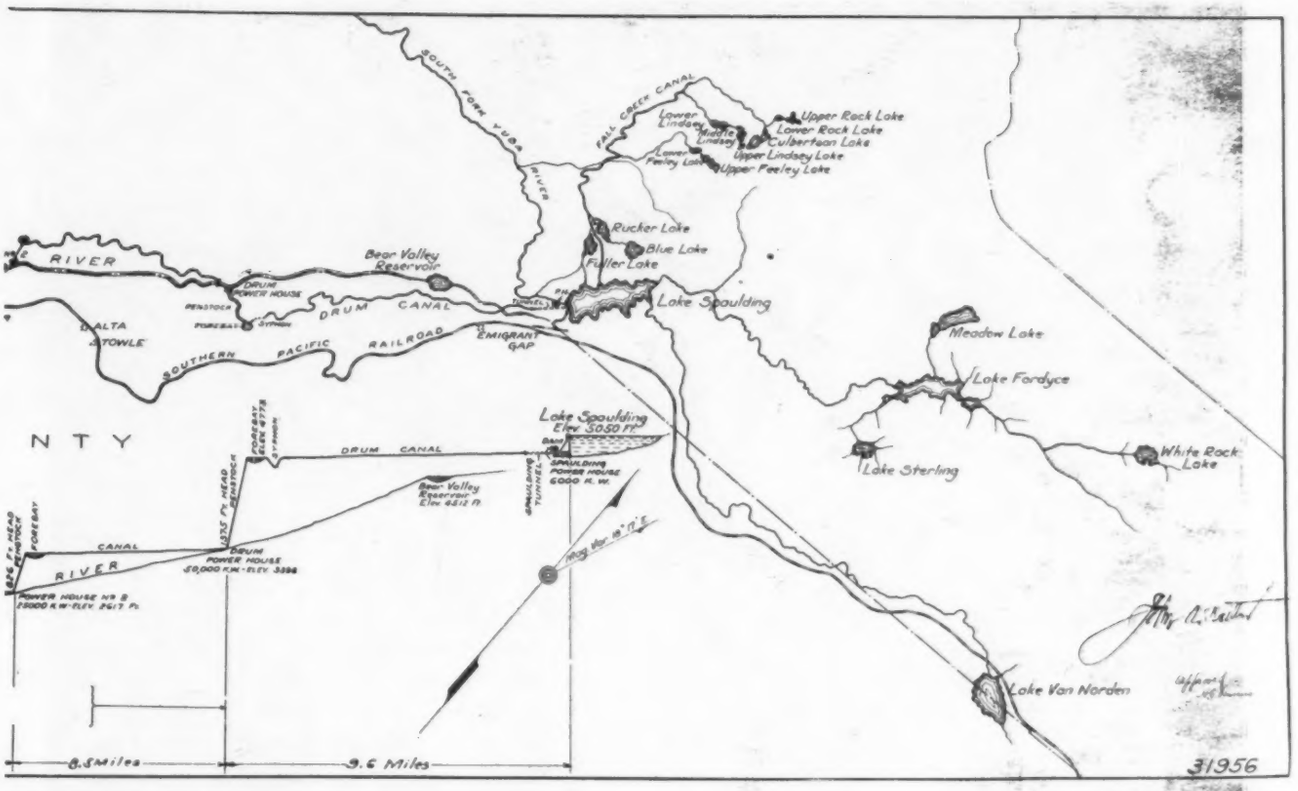
The generator which is of the Westinghouse design has a rated capacity of 12,500 k.v.a. It is directly connected with two Allis-Chalmers water wheel units, each of 9000 h.p. capacity. Electrical energy is generated at 6600 volts, three-phase, sixty cycles, at a rotative speed of 360 revolutions per minute. The governor is of the standard Allis-Chalmers design. The generator is separately excited by means of a 100 kw., d.c. Crocker-Wheeler dynamo which is directly connected to a 150 h.p. Pelton water wheel unit.

In the installation of the generating unit at this plant the shrinking of the rotor to its shafting proved to be an interesting problem in which the fifty-ton crane installed in the frame-work above proved most useful. The interior bore of the rotor was found to be fifteen thousandths of an inch too small and the shafting ten thousandths of an inch too large at the temperatures available at the power plant. Since the combined weight of shaft and rotor is fifty-five tons without pole pieces and with them becomes some eighty-four tons, the problem was well out of the ordinary for solution. A scheme was devised wherein the shaft was hoisted into an upright position and ice was packed in the hollow portion of the shafting so that the resulting contraction brought its diameter below normal, while the rotor was immersed in boiling water, thus expanding the rotor diameter above normal. At this point in temperature readjustment the rotor was lowered upon the shafting and today rotor and shaft are as a consequence shrunk together in such a manner that no lost motion between rotor and shafting may ever be anticipated throughout the life of the machinery involved.

A distinct feature of this plant is the location of the three large transformers of 4250 kw. capacity which are of the Allis-Chalmers design. The transformers are situated in separate concrete partitions in the main generating room at its western end. Unlike the Drum installation, they are placed in concrete pits so that about half their total depth is below the level of the power house floor, thus reducing the height of housing required and at the same time allowing ample space for hoisting the transformer parts when occasion requires. The transformer core weighs about twenty-three tons, the casing ten tons, and when equipped for service with forty-four hundred gallons of oil they will each weigh about fifty tons. They are nearly nineteen feet high and eleven feet in diameter.

The method employed in drying out these transformers is interesting. The steel casings for the transformer top is first bolted down so as to make an air tight compartment within. The air is then pumped out until about a twenty-two inch vacuum is obtained. Low pressure steam is then applied through the cooling coils, thus giving a quick and ready means of heat application for the drying of the transformer coils.

The transformers are tied in directly with the one hundred and ten mile Drum-Cordelia transmission



Spaulding Development.

system by the delta connection, so that 100,000 volts are thus delivered. On the other hand a Y connection by grounding the neutral is performed so that 60,000 volts may be delivered to a new steel transmission line that is being erected to connect the Halsey and Wise plants directly with the 60,000 volt service line now used in and about Stockton, California, some sixty-seven miles to the southwest. This new 60,000 volt transmission line is of the steel tower design with suspension insulators. Each insulator has seven units of ten-inch diameter.

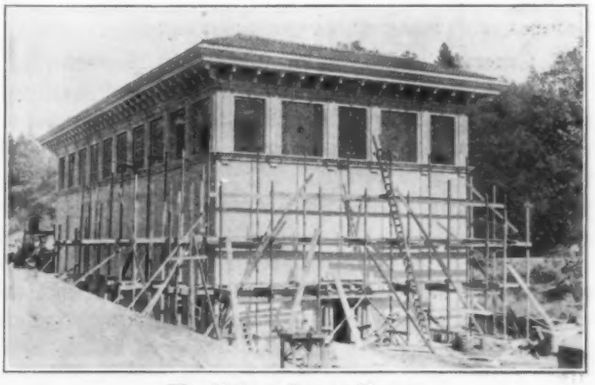
The Wise Power Plant.

The water from the Halsey plant passes out into a regulating pond constructed immediately below the power house. From this regulating pond it is conveyed through canals and tunnels and storage dams, finally dropping through the penstock a vertical distance of 519 ft. into the Wise Power Plant.

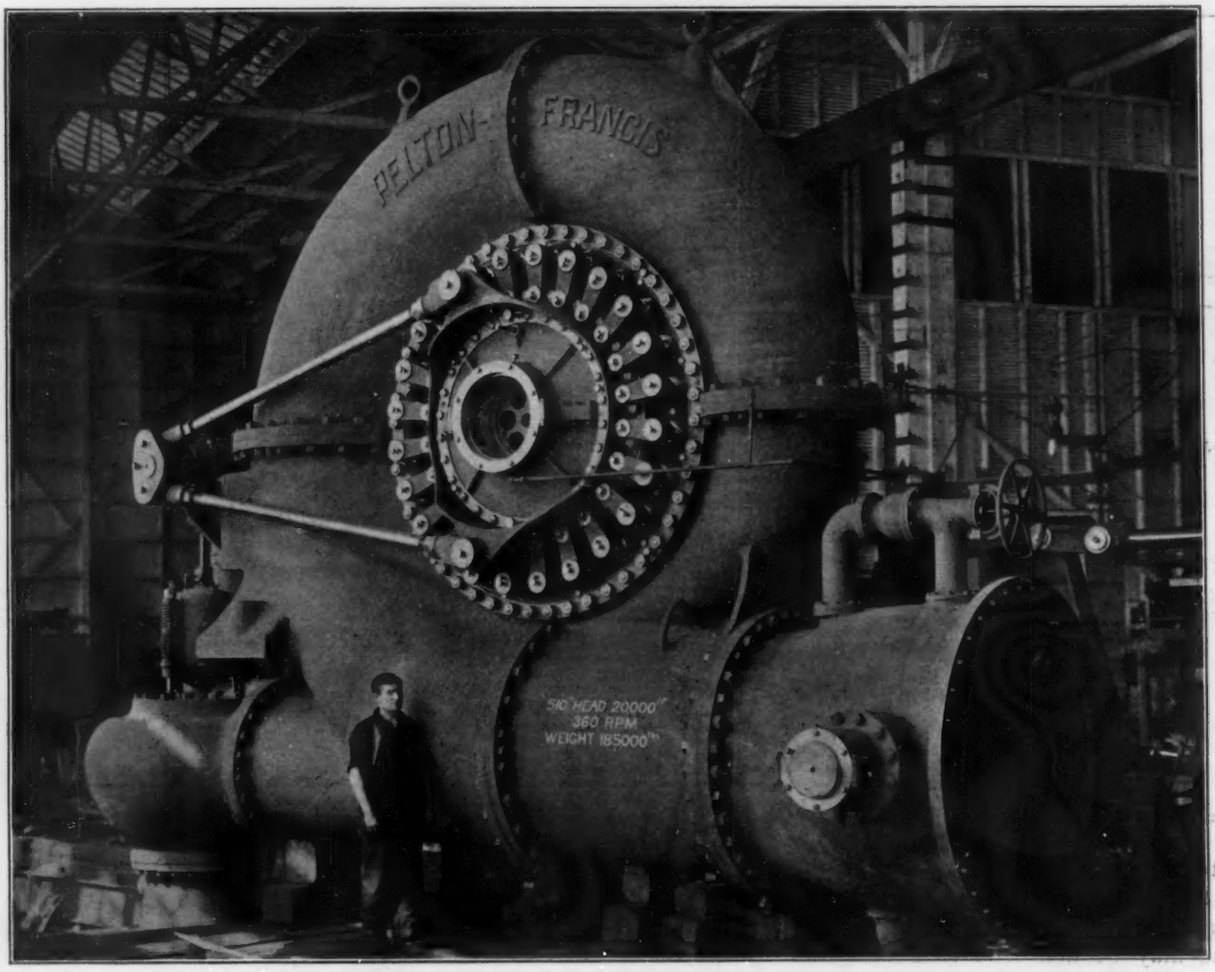
The generator and exciter units are identical with the Halsey installation. In the water wheel unit, however, a single installation of 20,000 h.p. capacity is made instead of two separate units. This water wheel unit is of the Pelton-Doble design and is the one exhibited by that company at the Panama-Pacific International Exposition. It is said to be the largest single discharge turbine in the world.

The generator speed being fixed at 360 r.p.m. and the available head at 510 ft., a single nozzle tangential wheel, having a specific speed of 5, would develop 100 h.p. To develop 20,000 h.p., the predetermined size of unit, would require 20 jets, a combination impractical under operating conditions. On the other hand, a turbine with a specific speed of 20, would develop 18,000 h.p. at 360 r.p.m. under a head of 500 ft. These limitations indicated a reaction turbine as the most suitable type of water wheel. The generator having been built for drive by a Pelton-Doble wheel, the shaft overhang was small. In the interests of

The Exterior of the Wise Power House.



The Halsey Power House.



The Twenty Thousand Horsepower Hydraulic Unit at the Wise Plant, the Largest Single Discharge Unit in the World.

economy, it was desirable to use the shaft of original design. To do this required a single discharge unit.

Because of the impact of the water column in a pipe line of the length found in this development, special care must be taken to avoid destructive surges. In the unit under consideration this is accomplished by means of a Pelton-Doble cataract type water economizing relief valve. This valve is controlled by the main rock shaft, directly actuated by the governor. With a sudden load rejection the relief valve is opened, and then is gradually closed, an adjustable time limit device maintaining the rate of closure to prevent a dangerous rise of pressure. On minor load rejections of a magnitude insufficient to set up dangerous surge pressures, the relief valve does not open.

Exterior and Interior of Power Houses.

In the housing of the electrical and hydraulic equipment, the exterior finish of the power houses for the Halsey and Wise plants is of high order. The compactness of arrangement, yet the freedom and accessibility throughout, impresses the visitor to these power plants. The tile roofing and architectural embellishments from without are simple in construction, yet this very simplicity is so subtly brought out that the tourist in an automobile on the Lincoln Highway which passes within a stone's throw of these power houses gains unconsciously a certain sense of respect and admiration for the service of this company which thus displays such simplicity and straight forwardness in design of its mountain hydroelectric plants.

The installation of the Spaulding Lake development is under the general supervision of John A. Britton, vice-president and general manager of the company. P. M. Downing has active charge of all work and serves as chief engineer with F. G. Baum as consulting engineer. J. P. Jollyman is in charge of electrical construction and H. C. Vensano is civil and hydraulic engineer. All construction work upon the project is in charge of James Martin. The Spaulding Lake addition is directly in charge of Otto W. Peterson. The building of the Rock Creek dam and other concrete work for the Halsey and Wise power plants is directly in charge of H. Van Erkeler, the laying of the penstock pipes is in charge of Fred Worley, while electrical construction upon the ground is in charge of Wm. C. J. Finely.

In conclusion, as one bears in mind the Spaulding Lake development as a whole and then recalls in mind the Halsey and Wise developments in particular, he cannot help but be convinced that once again the Pacific Gas & Electric Company is by these two concrete examples guaranteeing to the public throughout all posterity an even still better continuity of service and a safer investment due to such evident high class workmanship and utilization of the power rights held by this company in the high Sierras of California.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

Earth Ditch, Grass Grown and Irregular.

Earth Ditch Built with V-Crowder.

Earth Ditch on Steep Grade.

CONVEYANCE OF WATER IN OPEN CHANNELS ON THE FARM.

The conveyance of water from the point at which the supply is received, whether a pumping plant or a canal turnout, to the different fields and parts of each field on the farm, is an important part of the irrigation system. For the conveyance of large irrigation heads, such as are typical of practice in the irrigation of alfalfa under gravity systems, earth canals are used almost exclusively. For the smaller heads, generally less than 3 second feet, which are more typical of pumping plant practice, there is a greater choice of methods of conveyance. The three types of conveyance channels in general use are (1) ordinary earth ditches, (2) lined canals or flumes either of concrete, wood or steel, and (3) pipes usually of concrete. The latter class were discussed in the issue of September 16, 1916. Earth ditches are used for most farms. In certain localities or for certain crops the second and third classes are used quite largely. There is no one class of conveyance channel which is best for all conditions. The type to use in any particular case depends on the cost of water, the value of the crop, the size of the stream to be handled and the topography of the land.

Of the types of open channels, earth ditches are the most important. They are generally used for all methods of distribution except for furrow irrigation and even for this method, ditches will usually be found outside of certain portions of California. Lining of ditches to save seepage losses is now being employed on many canal systems. Such linings have not as yet been extended to farm ditches for the saving of seepage. Farm ditches are usually in use only part of the time and the total saving would be less in proportion to the cost. Concrete lined canals or flumes are used in some cases to permit a closer control and more uniform division of the water. For small heads such use is being replaced by concrete pipe. Wooden flumes may be used to cross depressions on the farm. Steel flumes are suited to such use but up to present they have not been used to as great an extent on the farm as on the canal systems.

Earth ditches.—The design of canal sections of large capacity is becoming relatively well standardized. For small laterals or farm ditches carrying five second feet or less the principles of design developed for larger canals cannot be as directly applied, as the conditions of use are more variable and the selection of empirical constants more uncertain.

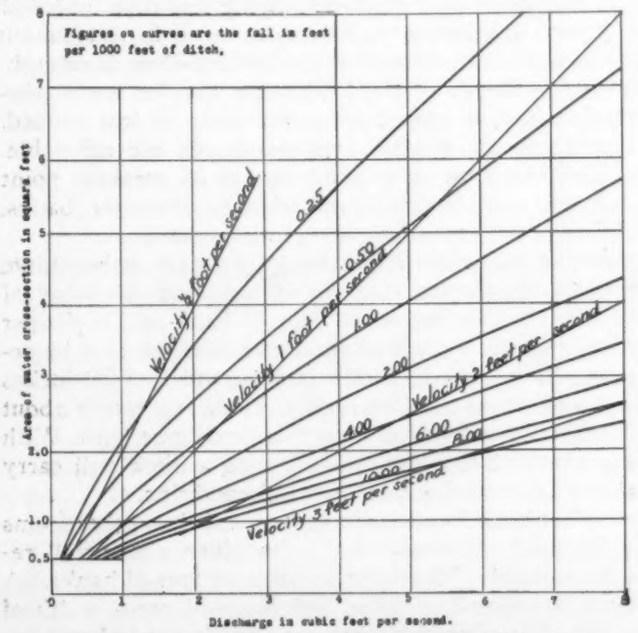


Fig 1. Carrying Capacity of Small Earth Ditches in Average Condition.

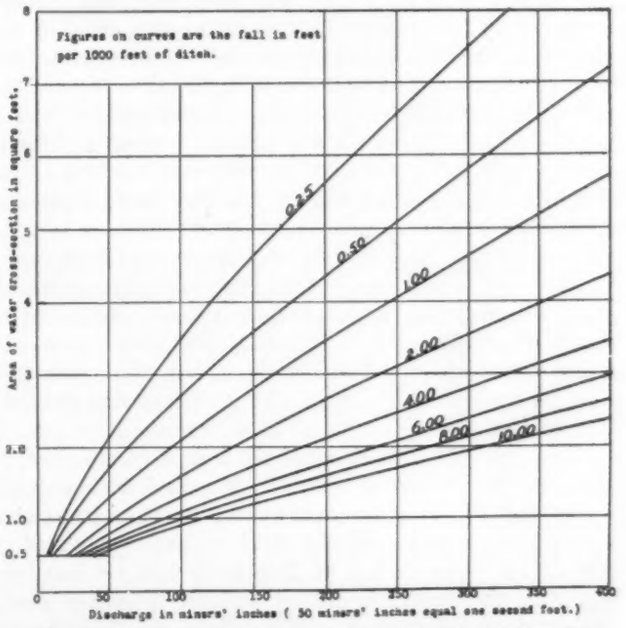


Fig. 2. Carrying Capacity of Small Earth Ditches in Average Condition Expressed in Miner's Inches.

The grass or weeds which may grow in the canal during periods between use have a greater proportional effect than similar growths on large canals so that the capacity of a farm ditch depends more largely on its condition than on its actual size. There is a certain minimum of size below which it does not pay to go. It is also usually better to build small ditches with excess capacity so that cleaning may not be as frequently required during the rush of summer work.

Various tables have been published showing the carrying capacities of small earth ditches of different sizes and grades. These are usually computed by the same formula used for large canals, the friction factor being selected for canals in average condition, for Kutter's formula the usual value of "n" being 0.025. From such tables, the curves given in Figs. 1, 2 and 3 have been plotted. In using these curves it should be remembered that some margin in capacity should be provided if unfavorable conditions are liable to occur.

Discharges are expressed in terms of second feet, miners' inches and gallons per minute, as all of these units are used in different irrigated sections. The miners' inches have the value of 1-50 of a second foot or 9 gallons per minute. This is the value employed in Southern California, Idaho and Nevada. The statutory value in California, Arizona and Oregon is 1-40 of a second foot.

In order to use these tables the grade of the canal and the area of the water cross-section are needed. The grades are expressed in terms of the fall in feet per 1000 ft. A grade of 1 foot in 1000 ft. corresponds to a little less than 3-16 in. per rod. This equivalent may be of use as many farmers are accustomed to figure grades in inches per rod. The velocity for a given ditch increases as the square root of the grade. While the carrying capacity of a canal depends to some extent on the form of the cross-section as well as the area, for small ditches the effect of the shape can be neglected as the form of cross section varies less than for large canals.

In Fig. 1, lines are drawn indicating the average velocities. These may be of use in determining the maximum slope if washing is liable to occur. It will be noticed, however, that for such small capacities the velocities secured, even with relatively heavy grades, are quite low. Most soils are able to stand a velocity of two feet per second when the original soil is exposed. The soil loosened by plowing in construction or in cleansing may erode at lower velocities but the amount of this cutting will usually not be large.

Having the desired capacity and the available grade the required area of water cross-section can be taken from the curves. Having the water area, the shape and dimensions of the ditch can be determined. For discharges of less than about two second feet the size of the ditch is more often determined by considerations of minimum size and the height of delivery.

In order to deliver water from a ditch into a check, the surface of the water in the ditch must be somewhat above the elevation of the land at the upper end of the check. For heads of 2 second feet or less, the water in the ditch should be at least 4 inches above the land, for larger heads a height of 6 inches is needed unless excessively wide boxes are used.

Small ditches are generally made by using the excavated material for the banks. Farm ditch banks should extend at least 3 inches above the high water mark where water is held 4 inches above the adjacent ground and 4 inches, where it is held 6 inches above. This gives a height of bank of 7 to 10 inches. Where water for a number of checks is controlled from one check gate in the ditch, the height of the banks just above the check gate may need to be higher.

On some fields less freeboard is used; however, the liability of delays and loss of water due to breaks is generally sufficient to overcome any saving. Where water is carried in a ditch most of the time, as in the supply ditches, a greater freeboard is desirable. Ditches

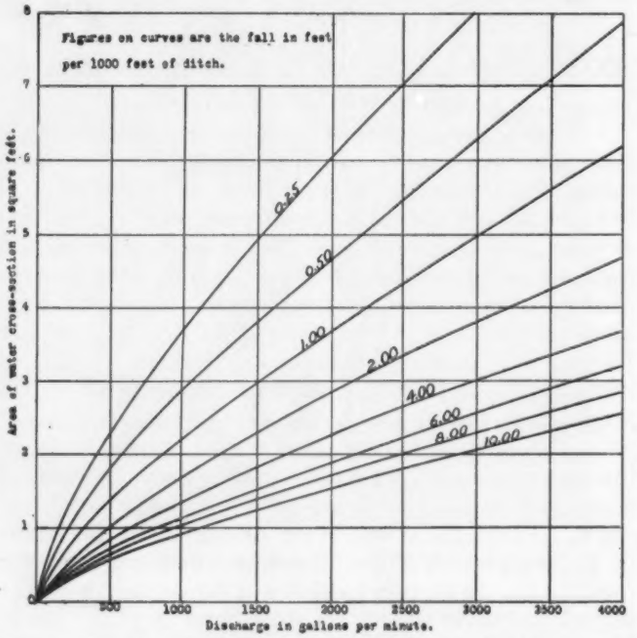


Fig. 3. Carrying Capacity of Small Earth Ditches in Average Condition Expressed in Gallons per Minute.

from which delivery to the land is not made can be built more largely in excavation.

For small field ditches carrying less than 5 second feet the top width of the banks can be made quite small; Sufficient width for walking, 8 to 10 inches, is enough. The side slopes of the banks can also be made relatively steep, as they are usually more or less sodded. For larger ditches more liberal banks are advisable. A ditch bank is only as strong as its weakest point and uniform work is preferable to irregular banks, although the average size may be greater.

The minimum ditch bank given, 7 inches high, 8 inches top width and one to one slopes contains ¾ of a cubic foot per lineal foot of bank or 1½ ft. per foot of ditch. Material for these banks would be secured from a ditch with a bottom width of 18 inches and a depth of cut of 8 inches. This represents about the smallest ditch that should ordinarily be built. With a grade of 1 foot per 1000 ft. such a ditch will carry about 2.5 second feet, if in good condition.

Earth ditches require more space than other forms of channel. The minimum size given above will require a width of 6.5 ft. between outer toes of banks. A ditch carrying 8 to 10 second feet will use a width of about 11 ft. Small ditches are usually made by plowing from 2 to 4 furrows and using a V-shaped drag

to crowd the earth into the banks. If the ditch is to be permanent it is usual to go over it and finish the section by hand. From two to four horses may be used on the drag or crowder. Ditch plows which form the ditch and banks at one operation are also used, the power required being greater. Such methods do not form compact banks and the ditches should be made in advance of their use in order to allow the banks to settle. Larger ditches are made with a slip scraper or a Fresno. Slip scrapers can be used along the line of the ditch if the bottom width is 30 inches or over. This enables the section to be finished more uniformly. The section is first roughed out by cross bucking or driving back and forth across the ditch loading in each direction.

The amount of material to be moved in ditches of this size is so small that the quantities can not be expressed conveniently in terms of cubic yards. The lineal feet of ditch is a more convenient term.

Where the earth is in good condition for plowing, two men and four horses may make a mile of small plowed and crowded ditch in a day. Ditches carrying 5 to 10 second feet can be built with scrapers for from 2 to 4 cents per lineal feet. This is much less than any other form of channel of equal capacity and accounts for the wide use of earth ditches even in very porous soils.

The annual cost of maintenance of earth ditches may be nearly equal to the first cost if frequent cleaning and weed cutting are necessary. If such cleaning is required at times when other farm operations require all the labor available it is liable to be neglected, resulting in wasting of water over the banks or the use of smaller irrigation heads. Well built large ditches requiring a minimum of attention during the season have a very material advantage in this regard.

RELATION BETWEEN FLUCTUATION IN WATER TABLE AND EQUIVALENT NET DEPTH OF WATER.

BY B. A. ETCHEVERRY.

In estimating the volume of drainage water to be removed by a proposed drainage system, one of the best and most generally used methods is to obtain by means of test wells the rate of rise in the water table during the period of maximum rate of rise and with this data and the properties of the soil for water holding capacity determine the equivalent net depth of water represented by this rate of rise.

For instance assume the following conditions and properties of a clay loam soil. First, at the beginning of the period of rise the water table to be 10 ft. below the surface and at the end of the period 7 ft. Second, the maximum water holding capacity of the soil against gravity near the surface, where the soil is essentially free from the effect of capillary action drawing the water up from the water table is 16 per cent of the soil volume (this includes hygroscopic and capillary moisture). Third the total pore space of the soil is 34 per cent of the soil volume. Then the soil moisture will be distributed in the soil depth somewhat as shown in Fig. 1. Curve 1 represents the moisture distribution before the rise of the water table; curve 2 after the rise has taken place. In both curves the pores of the soil immediately above the water table are entirely filled with water, from this point up towards the surface of the soil the percentage of soil moisture decreases, to a point where the action of capillarity in drawing water from the water table ceases. Above this point the curve is essentially straight, the moisture content being practically the same up to the surface of the soil. In Fig. 1 it has been assumed that the soil moisture is slightly less due to the effect of evaporation.

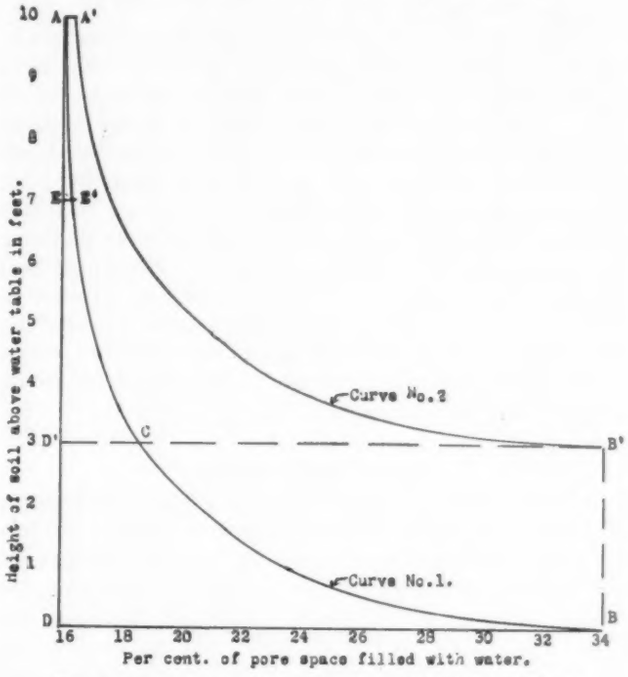


Fig. 1. Increase in Soil Moisture with Rise of Water Table.

The method generally used to obtain the net equivalent depth of water is as follows:

Total rise in water table, 3 ft.

Pore space occupied by hygroscopic and capillary water (when not influenced by the water table) obtained, for instance, by measurement of the soil moisture in the top foot of soil 16 per cent.

Total pore space, 34 per cent.

Pore space occupied by drainage of gravity water, 34 less 16 or 18 per cent.

Total net depth of excess water represented by rise of 3 ft., 18 per cent of 3 ft. or 6.48 inches.

If this rise occurs in one month the daily depth of drainage water to be provided for in the system is then 6.48 divided by 30 or 0.216 inches.

By this method the moisture added to the soil is that represented by the rectangle D'B'BD (Fig. 1). The actual amount of soil moisture added is that included in the tapering area A'B'BA included between the two curves. A study of the diagram gives the following relations:

$A'B'BCAA' = CB'BC + A'B'D'AA' - ACD'A.$

$D'B'BDD' = CB'BC + ACBDA - ACD'A.$

equal to ACBDA, the difference being equal to AEE'A which is negligible, DE being equal to D'A. This can readily be seen if it is remembered that the curvature of curve 1 and of curve 2 is similar and that the base and altitude are the same for A'B'D'AA' and for E'BDEE'.

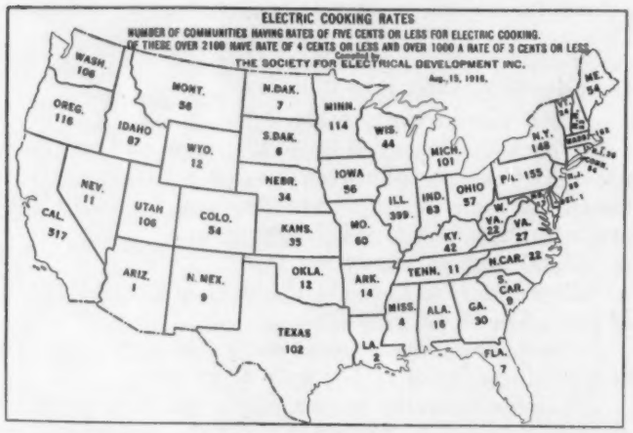
This demonstrates that the usual method is essentially correct.

If however, the rise of the water table is sufficient so that the moisture in the surface soil is materially increased, the area similar to AEE'A becomes greater and the difference in the quantities obtained by the two methods becomes larger. Where the moisture in the surface foot is increased by the rise of the water table the quantity of water added to the soil is less in proportion to the rise.

The curves in Fig. 1 are suggestive of the probable form rather than representative of the numerical conditions in any case. The height through which water will rise by capillarity varies with the type of soil, being greatest in the heavy soils. When the depth of the water table in such soils is less than the limit of capillary action, the addition of a given quantity of water will raise the water table a greater distance due to the greater moisture content of the upper soil and the smaller amount of water needed to saturate it. Where the moisture in the surface foot exceeds the field capacity with free drainage, the methods previously illustrated will give too large quantities to be removed by the drainage.

HEATING RATES.

The rapidly increasing demand for electric ranges, with their convenience, reliability and cleanliness, has led to an investiation of rates for electric current by the Society for Electrical Development. This load for central stations is extremely desirable, because the bulk of it comes on the off-peak, and thus assists in straightening the load curve. The accompanying map



shows the number of communities having special cooking rates and the location of these communities by states.

In analyzing the compilation of rates for electric cooking in the United States the interesting fact develops that of some 3000 communities listed where rates are 5c or lower, 1884 are located in the eastern half of the country, and 1250 in the western half, or, taking the Mississippi as the dividing line, 1638 are east of the Mississippi as against 1506 west of the Mississippi River.

Contrary to the general impression that low rates for cooking are largely confined to the Western States, it will be seen that central stations in the East have realized the advantages of this load and are offering special rates as an aid in building it.

THE COST OF PROGRESS.

BY LESLIE CRAVEN.

(This lucid explanation of functional depreciation constitutes the first part of a paper on "Adequate Protection Against the Risks of Obsolescence and Inadequacy" presented at the Seattle convention of the Northwest Electric Light & Power Association, Sept. 8, 1916. The concluding portion of the paper, wherein a remedy is suggested, will be published next week.—The Editor.)

The question of obsolescence, and of the proper protection of investments in electric light, power, and traction equipment against the losses caused by obsolenscence, is one of the most intangible and perplexing questions with which the investors in such property and those engaged in managing and operating it, must deal. The difficulties of the question have been great throughout the history of electrical industry and have been magnified by the present day system of the regulation of such investments and their earnings upon the basis of physical valuation. Because of the fact that the problem is peculiar to each plant, it has not been found practicable in this discussion to treat the question otherwise than in a general manner. Brief consideration of the questions involved will explain and justify this course. In a time when the practical mind seeks definite information upon all questions, it is the regret of the author that such treatment is necessary.

We may begin with this fundamental proposition; a utility engaged in a public service undertaking which involves the employment of property the life of which is limited in duration, is entitled to a fair return on the investment and in addition, to collect such sums as will be sufficient to replace the property at the end of its life. One right is as certain and necessary as the other. One secures a fair compensation for the use of the property and the other insures the investor against the dissipation of the property while in that use. This is an elementary proposition universally recognized by courts and commissions. An interesting discussion of the principle is found in the case of Fuhrmann vs. Cataract Power & Conduit Company, decided by the New York Commission of the Second District and reported in Vol. 3, page 657, of its decisions.

The duty of the maintenance of the investment is a duty which is owed both to the security and stockholders and to the public. The duty is imposed by the public utility laws of many of the states. The United States Supreme Court has recognized the duty in emphatic language in the case of Knoxville vs. Knoxville Water Co., 29 Sup. Ct. 152, where the court said:

"A water plant, with all its additions, begins to depreciate in value from the moment of its use. Before coming to the question of profit at all the company is entitled to earn a sufficient sum annually to provide not only for current repairs, but for making good the depreciation and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste, without making provision out of earnings for its replacement. It is entitled to see that from earnings the value of the property invested is kept unimpaired, so that, at the end of any given term of years, the original investment remains as it was at the beginning. It is not only the right of the company to make

such a provision, but it is its duty to its bond and stockholders, and, in the case of a public service corporation, at least, its plain duty to the public. If a different course were pursued the only method of providing for replacement of property which has ceased to be useful would be the investment of new capital and the issue of new bonds or stocks. This course would lead to a constantly increasing variance between present value and bond and stock capitalization,—a tendency which would inevitably lead to disaster either to the stockholders or to the public, or both. If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon overissues of securities, or of omission to exact proper prices for the output, the fault is its own. When, therefore, a public regulation of its prices comes under question, the true value of the property then employed for the purpose of earning a return cannot be enhanced by a consideration of the errors in management which have been committed in the past."

In this authoritative announcement of the Supreme Court there is imposed upon the utility the duty, already imposed by the dictates of good management, of charging adequate rates to enable the protection of the integrity of the investment, and of properly applying the funds thus received to the use which justifies their collection.

The depreciation against which the integrity of the plant must be protected, is of two sorts: the first is termed physical depreciation. Physical depreciation is the loss of value due to the deteriorating influences of wear or age. This is the ravage of use and time which current maintenance does not repair. The second is termed functional depreciation. This is the loss of value resulting from lack of adaptation to function due to other causes than physical deterioration. It is of two sorts. One is that lack of efficient and economic adaptification to function which results from the existence of more efficient and economical equipment produced by improvements of the art. Another is that lack of adaptification which is the result of a growth or shrinkage of business, or of regulations requiring changes in construction and enforced by governmental authority. By reasons of these causes, reconstruction and replacements are required and equipment which is mechanically and physically sound is junked before the end of its normal life. It is with this risk and with these losses, and their effect upon the cost of service, that we are concerned. It is obvious that obsolescence and inadequacy are forms of depreciation. They affect the cost of service in a way similar to wear and tear, or physical depreciation.

In an age which will probably be known to future generations as the Age of Invention, science has made no greater nor more rapid advances than in the field of electrical engineering. In no business has there been a quicker or more zealous adoption of the discoveries of science than in the industries of electric light, power and traction. Concurrent with the progress of the science and its application in industry, there has been remarkable territorial expansion and the growth of cities. Urban population, and particularly that of the West, and in no part of the West as in the Northwest, has increased phenomenally. Towns have become cities prematurely. The public demands and deserves the best of service. The duty of furnishing adequate service is a duty imposed upon the public service utility by common and statutory law. Thus the great problem which has faced these utilities of the Northwest has been that of giving adequate service to this rapidly growing population, when the equipment necessary to that service has been undergoing a process of rapid evolution. There has been a race, therefore, to keep up not only with the demands of the public, but with the progress of the science, and to secure from the public adequate compensation to pay the cost of progress. Here arises the problem of obsolescence and inadequacy.

Horse cars were superseded by cable cars. Electric cars took the place of cable cars and the expensive equipment of cable systems with narrow tracks and costly conduits were scrapped. Heavy electric rolling stock superseded the light electric rolling stock of pioneer days. Heavier equipment in cars required heavier rails, stronger bridges and bigger and better generating equipment. The path of progress is strewn, not with the wrecks of worn-out equipment, but with piles of good equipment, physically and mechanically sound and representing thousands of dollars of invested capital, upon which there has not been a complete return and the investment in which has not been regained by the investors in the form of adequate replacement annuities.

The phenomenon is familiar to every one. A most striking example has recently come to attention in the instance of the Harrison Street Station of the Chicago Commonwealth Edison Company. This plant was built in 1893 and placed in permanent service in 1894. The equipment consisted of high grade water tube boilers and compound and triple expansion engines directly connected to the generators. The maximum peak load upon the plant was 18,826 kw. This plant when constructed was a model of efficiency and economy. It embodied the most advanced products of engineering thought. Experts from the world came to this station to study advanced central station practice. The advance of science has been such, however, that no additional machinery was installed after 1903, and since 1910 the station has been used only as a reserve plant and for standby service. This year the plant has been demolished. It produced in the course of its history only 534,783,000 kw.-hr.

The very remarkable development of the turbine engine is one of the most striking instances of progress of the art. Turbines have rapidly superseded reciprocating engines. Improved and larger turbines in mammoth units are superseding the smaller turbines of the earlier models. Generators adapted to piston engine practice are not adapted to turbine engine practice. Higher pressure is needed from the boilers. Condensers must be changed to give better vacuum.

A similar development has been shown in the creation of new types of lighting equipment. One of the large utilities operating in the Northwest invested over $50,000 in the Nernst lamp, only a few years ago. These lamps were expensive in cost and operation, and although a very decided improvement over any lamps which had been developed before that time, after a

few years of service were superseded by equipment of greater efficiency. In Portland, Oregon, during the last twenty-five years, the arc street lighting equipment has been completely changed four times.

Mr. R. H. Ballard, secretary and assistant general manager of the Southern California Edison Company of Los Angeles, has made a careful study of the rate of obsolescence among western utilities. In the course of his study, he investigated the lives of 34 reciprocating engines, 16 turbines, and 50 generators which had been replaced because of obsolescence and functional inadequacy. His study of this equipment, all of which had been retired before the termination of its natural life by reason of functional inadequacy, showed that the reciprocating engines in question had a life of 14½ years, the turbine engines a life of 5¾ years, and the generators 15¾ years. The mortality tables commonly in use show a probable life for all of this equipment of from 17 to 25 years.

A source of risk of equal importance is the lack of adaptification to function resulting from a growth of business. Growth of cities has meant the growth of business, and the growth of business has meant the enlargement of capacity and the necessity for better service. This has caused the retirement of much equipment which has not been worn out in service. In these cities of the Northwest, which have been characterized by a rapid growth, many examples are afforded of these premature retirements. Large losses are occasioned to gas companies by the necessity of replacing mains made inadequate because of the growth of business. A similar risk is the loss of business occasioned by the movement of centers of trades to other parts of the city. In a field of investment other than that of public service, office buildings left stranded by the migration of the business district of a city are frequent examples of this same sort of functional depreciation.

More serious are the losses caused by improvements required by governmental authority. Progressive communities enact progressive legislation, the purpose of which is to require progress by the utility. What are virtually public improvements are thus often made, and not at public expense. Ordinances are frequent which require the tearing down of overhead distribution systems and the construction of underground conduit systems. The property loss of such a reconstruction in the city of Portland, when such a change was required in the downtown business section, was $75,000. Great losses are occasioned by the change of street grades and the consequent reconstruction, and by ordinances requiring the widening of streets, and by legislation requiring changes in the types of car fenders and other safety devices. In several of these northwestern communities successive ordinances have been passed embodying the individual ideas of successive municipal authorities and requiring successive rearrangement of the spacing of wires on poles.

The instances which have been here cited are sufficient to illustrate the nature of functional depreciation. These instances show one predominant characteristic which distinguishes functional depreciation from physical depreciation. Physical depreciation is as certain as death. It accrues. There is a gradual wearing away of a machine or a railroad rail under regular wear which assumes a progression proportionate to use and age. It follows a course the line of which may be platted with a degree of accuracy sufficiently close to enable the calculation of the replacement funds which should be accumulated to restore the property, when it is retired because of that use and age. Functional depreciation, however, is apt to come without warning. It is a risk similar to the fire risk and in a common category with the risks of loss from storms or acts of God, in that it is difficult to foresee, and in that the happening of the event destroys the value of equipment of recent design as well as equipment of earlier design. Changes in the art, or changes required by legislation, bear little relation to the age of the particular structure or machine. During the next year it is possible for an Edison or Steinmetz to develop a process of power development or transmission which may relegate to the scrap heap much of our generation or transmission equipment, but the extent of the revolution of the art produced by that development, and, when, if ever, it will occur, lie only within the realm of prophecy. In a similar way the rate of the growth of business is difficult to foretell since community growth is subject to various contingencies. How long a down town city substation will be adequate to supply the demands, is a matter only of conjecture.

ELECTRICAL DEVELOPMENT—COMMERCIAL AND FRATERNAL.

The great campaign that is now sweeping the country to put the uses of electricity before the American people is not alone reaping vast returns in laying the groundwork for future industrial sales and applications of electrical energy, but the spirit of co-operation and fraternal feeling that is being engendered on all sides is of high order.

A Typical Frolic of the Electrical Fraternity.

Business gatherings and social gatherings of electrical men are being held in all great centers of the country. The cartoon that is here shown is that of the Cleveland Jovians in a recent dedication of their comfortable new quarters. During the social gathering, real spice was added to the program by the arrival of a terrific thunder storm. Thus was Jupiter and his thunderbolts emphasized to a greater reality than in the usual ceremonies of the Jovians. The cartoon appeared in the Cleveland Leader.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Sunlight is one of the worst enemies of rubber. It rots and destroys automobile tires very quickly. Covers should therefore be provided for all extra tires carried on autos.

* * *

An innovation is being put into practice by H. S. Cooper, secretary of the Southwestern Electrical & Gas Association, who visits the plants and properties of the members, taking from each new ideas and helpful information that may be passed along to the next plant in the district.

* * *

The net earnings of the U. S. patent office for the year 1915 amounted to over two hundred thirty-seven thousand dollars. This is the only governmental department which annually appears on the earning side of the ledger. Its total earnings now amount to over ten million dollars.

* * *

During the past several months the electric flag sign has enjoyed popularity and many of them have been installed in various cities of America. Flood lighting the American flag is now, however, becoming equally popular and from a spectacular standpoint even more effective.

* * *

As an example of the gigantic growth of the modern electric lamp business, one prominent eastern firm now employs five thousand workers and turns out seventy-five million lamps per year. If placed only fifteen feet apart this is sufficient in number to make a great white way from the earth to the moon.

* * *

The current consumption in the production of ice from raw water by the ammonia-compressor process varied from 52 to 98 kw.-hr., with an average of 71 kw.-hr. per ton in a plant served by the Texas Power & Light Company. The variation is due to operating characteristics and seasonal temperature changes.

* * *

For purposes of advertising and attracting the notice of automobile travelers approaching the city, an eastern hotel management has reaped rich harvests by erecting a high powered searchlight upon the topmost pinnacle of the building. This is an idea that should receive practical application in many places of the west.

* * *

During the last five years the growing of alfalfa has steadily developed in Argentina. It is estimated that in 1914 these were nearly twenty million acres of land thus employed in this great South American Republic. It would seem that American made electric pumps and motors ought to find a wide field of application in Argentina.

* * *

In climate and physical features northern Manchuria is strikingly similar to the Dakotas. The climate is exceedingly dry, sunny throughout the year, and healthful. In agricultural possibilities, especially for grain, it is the most promising province in ancient China. Abundant opportunities for power development are also found there.

* * *

The stand of timber on the two great national forests in Alaska is estimated by the forest service as over 70,000,000,000 board feet, while the annual growth will, it is said, produce of pulpwood alone enough for the manufacture of 3000 tons of wood pulp a day.

* * *

The commercial department of the Pacific Telephone & Telegraph Company is evidently strongly impressed by the possibilities of a co-educational university town, as evidenced by the following requisition recently placed by the Palo Alto Exchange: "One 'osculating' electric fan, size 12 inches, 60 cycles, alternating current, 110 volts.

* * *

Both houses of Congress have now authorized the largest naval constructive program every adopted by any nation in the world in an appropriation of some three hundred fifteen million dollars. The program contemplates beginning construction on 156 ships within the next three years, 16 of which are to be capital ships—four battle cruisers and four battleships the first year.

* * *

"When scientific work is solely with the object of securing commercial gain, its correlative is selfishness; when it is confined to the path of narrow specialization it leads to arrogance; and when its purpose is materialistic domination, without regard for the spiritual needs of humanity, it is a social danger and may become an excuse for learned barbarity."—Professor R. A. Gregory, in "Discovery, or the Spirit and Service of Science."

* * *

Various electrical inventions have been in recent years put on the market to replenish the oxygen in the air in stuffy rooms and in mines. The U. S. Bureau of Mines has found that atmospheres that are deficient in oxygen begin to affect men when the percentage of oxygen is about as low as that affecting canaries and mice. When the oxygen content is about 7 per cent mice show considerable distress, and a man is in grave danger of dying.

* * *

To make a successful fight against moving sand-dunes such as those of the Columbia River region and other places along the Pacific Coast, the United States must follow the plan adopted by France many years ago and build one great dune in an effort to eliminate many smaller ones. This is the verdict of the forest expert who has made a world-wide study of the subject. Some years ago three hundred miles of coast line on the Bay of Biscay was being blown inland by the winds of the Atlantic Ocean. The construction of a great artificial lateral dune along the coast line threatened saved the day for France.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION ETC., required by the Act of Congress of August 24, 1912, of "Journal of Electricity, Power and Gas," published weekly at San Francisco, for October 1, 1916.

State of California,

County of San Francisco—ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared E. B. Strong, who, having been duly sworn, according to law, deposes and says that he is the business manager of the "Journal of Electricity, Power and Gas," and that the following is, to the best of his his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Names of	Post Office Address.
Publisher, Technical Publishing Company	San Francisco, Cal.
Editor, A. H. Halloran	No. 6 Crossley Bldg., San Francisco
Managing Editor, A. H. Halloran	No. 6 Crossley Bldg., San Francisco
Business Manager, E. B. Strong	No. 6 Crossley Bldg., San Francisco

2. That the owners are:

E. B. Strong	San Rafael, Cal.
R. J. Davis	Berkeley, Cal
A. H. Halloran	No. 6 Crossley Bldg., San Francisco
C. L. Cory	Nevada Bank Bldg., San Francisco
Robert Sibley	Berkeley, Cal
Mrs. L. B. Storey	Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

E. B. STRONG, President.

Sworn to and subscribed before me this 19th day of September, 1916.

(Seal) CHARLES EDELMAN,

(My commission expires April 7, 1918.)

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Electric Range Discounts

Considerable dissatisfaction has been expressed among Western power companies regarding the preferential price that the electric heating licensee committee has granted the jobber in purchasing electric ranges. No objection is raised to the jobber being given a better discount than the central station on lamp-socket heating devices, whose market has been well developed, but the central stations feel that the electric range is still in the period of exploitation.

They argue that neither the jobber nor the dealer have as great an incentive to sell ranges as has the central station, whose real return comes from future sales of current consumed by the range. Their experience has shown that the present cost of selling a range is out of all proportion to the amount received from its sale. As the central stations are assuming the burden of the high cost of exploitation, they believe that they should be able to purchase the ranges at as low a price as do the jobbers, especially as they buy equally large quantities.

The jobber, on the other hand, argues that he is the legitimate channel for the wholesale distribution of electrical goods. He carries a large stock, assumes credit risks, serves a large number of retail dealers throughout a wide territory and employs a staff of specialized salesmen. Without the jobber, the small retailer could not exist. The retailer is in direct contact with the public, and can do much to make or mar a favorable public opinion of the public utility corporation.

The central stations find that a great deal of money must be spent in educational work and direct soliciting and demonstrating among consumers. The question here arises as to whether some of this money if spent in educating the dealer would not ultimately be more effective in selling ranges. An educative campaign among the dealers has been found to be a necessary preliminary to sales effort direct to consumers. When dealers fully understand the advantages of electric ranges their intelligent co-operation will do more to put stoves on lines than any amount of house-to-house canvassing by central station solicitors.

A long-range view of the matter is desirable. Immediate expediency should not stand in the way of eventual profits. Fundamentally, this is a proposition of live and let live. The central stations need the support of the jobbers and dealers in many ways. If they proceed regardless of such considerations, if they do not allow some slight advantages to co-workers, it is doubtful whether this support will be available in time of need.

The big way, the broad-gauge method of far-seeing men in such a case, is to make a slight sacrifice in order to gain great benefit. The central station, under this plan, should not begrudge the jobber a slight differential, for to the power company the profit comes not in the sale of the range, but in the sale of the current consumed by the range. By encouraging the activity of the jobber the power company thus increases current consumption.

The jobber has voluntarily assumed the task of teaching the dealer. He needs help and co-operation from the manufacturer and central station if his in-

struction is to be carried to the final fruition of better business for every branch of the industry. A ten per cent differential seems little enough encouragement for this and other services rendered by the jobber.

The Small Ditch and its Upkeep

The discussion of open channels used for irrigation purposes which appears on another page of this issue will undoubtedly be welcomed by a large group of men interested in irrigation pumping. Especially for those interested in irrigation pumping for the small farm unit will this article prove of unusual value.

Hitherto, the construction of the small laterals used for such purposes have largely been designed by rule of thumb. Recently derived theory and practice have in a large measure standardized this class of ditch construction and the author of this article has set forth methods of arriving at the proper proportion of parts to be used in any given case.

One of the strong points to bear in mind in proportioning ditches of this type is the lower limit beyond which ditches should not be designed.

The growth of weeds and grasses with its deleterious effect is also emphatically called to the attention of the reader. Orchardists in California and the West have long struggled with the advancing rate of growth of Bermuda and other grasses. At first it was thought that such growths simply made the irrigation system unsightly. In the case of rice growing, however, weeds and grasses appearing in the canals are found by their seed carrying power to materially effect the production of crops, to say nothing of their ability to reduce the carrying capacity of the ditch.

Indeed so harmful from every consideration has the growth of weeds and grasses in canals proven that now in many instances farmers and agriculturists generally are finding it far better to adopt concrete piping for canals in every instance possible.

Since open channels are far cheaper in construction, their use will, however, long play the leading role in farm irrigation methods. As a consequence the data set forth in this issue, the first of its kind to appear in collateral form, will undoubtedly be welcomed from all quarters.

Since engineers and farmers still use different languages in expressing the carrying capacity of ditches, for the sake of extreme clearness and usefulness in application of the data set forth in this article, three separate charts have been prepared, the first giving the carrying capacity in cubic feet per second, the second the carrying capacity in miner's inches, and the third in gallons per minute.

To be independent of charts, however, it is well to bear in mind that one cubic foot of water per second is by statute equivalent to 40 miner's inches in some Western States, while in others it is equivalent to 50 miner's inches. The charts constructed by the author adopt the latter unit.

Still another unit that often appears perplexing to the irrigationist is the acre foot and how to convert this unit with miner's inches or cubic feet per second.

An acre foot of water means such a quantity of water as will flood an acre to a depth of one foot. Since no time element appears in this unit, it is necessary to introduce such a unit if a relationship between acre feet and cubic feet per second is desired.

Thus one cubic foot of water per second means a flow of 86,400 cubic feet in twenty-four hours. Since an acre flooded to a depth of one foot is equivalent to a storage of water of 43,560 cubic feet, it is evident that a cubic foot of water per second flowing for twenty-four hours must be drawn from a source having a storage capacity of almost two acre feet.

The Personal Factor in Engineering

The theme of the water-fall has ever been interwoven into the daily hum-drum of human life, an enchanting veil of mystery and exquisite beauty. During the past twenty-five years, however, this thought has been transformed into the practical easing of human burdens brought about by means of the physical harnessing of the vast latent powers possessed by water as it passes in its journey from the mountain to the sea. In California this development has been marked to a greater degree than any other section of country in the world. Especially is this true in Central California where the perpetual melting of snow in the white-capped Sierras has made possible unusually favorable conditions for such development work.

Typical of this unprecedented growth in hydroelectric generation of power is the gigantic network of the Pacific Gas & Electric Company which generates its power in some eleven hydroelectric plants situated in the high Sierras and transmits this subtle electric force through fifteen hundred miles of pulsating, high-tension distribution lines, thereby serving with heat and light for the comfort of its citizens and with power for the driving of its industries a population of a million and three-quarters in thirty of California's counties.

A consideration of certain of the physical aspects of this great world beating system of hydroelectric transmission detailed on another page of this issue is not the only thing from which engineers and citizens of the West draw inspiration.

The men who have dreamed the dreams that have brought to reality this throbbing, life-giving enterprise in California are in themselves a source of inspiration to well-wishers of the West to a greater degree than the actual physical accomplishments they have brought about in harnessing these great natural burden-lifters.

It is most fitting that those having the matter in charge have named one of these new power plants in memory of James Hugh Wise, who was a young and enthusiastic engineer in the company's employ and who will ever remain a living source of inspiration to all who knew him, and to whom California and the West will ever be indebted for dreaming the dream that in a large measure made possible the Bear River scheme of development.

From the veteran worker of forty years' service who today stands at the head of this great corporation down through his corps of young, enthusiastic helpers, California and the West may well feel a sense of pride in contemplating the enthusiasm, loyalty of purpose and constructive imagination with which these men have performed their service to the state.

PERSONALS

J. W. Swaren of the Pelton Water Wheel Company, is making a month's trip East.

Robert Tchumay, electrical contractor of Visalia, Cal., was at San Francisco this week.

Percy H. Thomas, consulting engineer, is expected at San Francisco from New York this week.

Walter M. Fagan, representative of the Hughes Electric Heating Company, is at San Francisco.

F. H. Leggett, Pacific Coast manager Western Electric Company, returned to San Francisco this week from an extended eastern trip.

C. F. Conn has closed the San Francisco offices of the J. G. White Engineering Corporation and will leave for New York City early in October.

E. C. La Rue, United States hydraulic engineer, formerly at Salt Lake City, has been assigned to the special water-power investigation in Oregon.

Geo. Gray, Pacific Coast representative of the Condulet Company, has returned to San Francisco from a motorcycle trip through Southern California.

A. B. Day, manager of operation for the Los Angeles Gas & Electric Corporation, has been elected a member of the American Institute of Electrical Engineers.

H. S. Whiting, president Pierson-Roeding Company, leaves for Atlantic City this week to attend a convention of the district managers of the Aluminum Company of America.

A. E. Wishon, assistant manager and **E. A. Quinn**, general superintendent San Joaquin Light & Power Corporation, have returned to Fresno from San Francisco.

J. A. Herr, one of the most popular salesmen with the San Francisco office of the General Electric Company, left this week to join the sales force of the Boston office of the Sprague Electric Works of the General Electric Company.

H. M. Byllesby, president of H. M. Byllesby & Co., of Chicago; **O. E. Osthoff**, vice-president of the company; **H. L. Jackman**, manager at Eureka, Cal., and **H. H. Jones**, manager at San Diego, were at San Francisco during the past week.

E. H. Warner recently resigned as resident engineer for the Kern River No. 3 plant of the Southern California Edison Company in order to open offices at Los Angeles as consulting engineer. **F. E. Mills** has succeeded him at the power plant.

G. F. Chellis, electrical engineer with J. G. White Engineering Corporation, and **H. N. Kelfer**, sales engineer with Northern Electric Company of Vancouver, B. C., have been transferred to the grade of member in the American Institute of Electrical Engineers.

S. C. Bratton, commercial manager Portland Gas & Coke Company, addressed the N. E. L. A. section of the Pacific Gas & Electric Company, September 26th, on the subject of "Up-to-the-Minute Selling Methods," his paper on which was awarded the gold medal by the Pacific Coast Gas Association.

W. G. Stearns, formerly in charge of the Portland office of the Standard Underground Cable Company, assumed the duties on September 1st of assistant to manager as well as continuing his duties as chief salesman for the San Francisco district.

D. C. Green, formerly connected with the organization of H. M. Byllesby & Co. as local manager at two Oregon and Washington properties, has been appointed general manager of the Fort Smith Light & Traction Company, Fort Smith, Arkansas, succeeding **H. C. Hoagland**, who has been managing that property in connection with his work as manager of the Muskogee Gas & Electric Company for some time past. Mr. Hoagland will continue as manager of the Muskogee Gas & Electric Company. The change took effect September 26.

C. B. Babcock, manager of the General Gas Light Company at San Francisco, has been elected president of the Pacific Coast Gas Association, **J. D. Kuster**, manager of the San Jose district of the Pacific Gas & Electric Company, vice-president, and **Henry Bostwick**, secretary to the president of the Pacific Gas & Electric Company, secretary-treasurer. The directors are: **F. S. Wade**, Southern Counties Gas Company, Los Angeles; **S. Waldo Coleman**, Coast Counties Gas Company, San Francisco; **H. W. Jackson**, manager James Graham Manufacturing Company, San Francisco; **C. A. Luckenback**, construction engineer Los Angeles Gas & Electric Corporation, Los Angeles; **John A. Britton**, vice-president Pacific Gas & Electric Company, San Francisco; **Z. T. Bell**, superintendent San Bernardino Valley Gas Company, San Bernardino; **Leon B. Jones**, assistant gas engineer Pacific Gas & Electric Company, San Francisco.

MEETING NOTICES.

Electrical Development and Jovian League.

The principal business transacted at the September 20th meeting was participation in the Path of Gold celebration. T. E. Collins reported that the League's float would be mounted on a long auto truck as no street cars were available. Harold von Schmidt, winner of the Society for Electrical Development's poster contest was introduced and announcement was made that an animated representation of his "Aladdin" poster would be incorporated in the league's float. N. J. Prendergast, as chairman for the day, then introduced Arthur Arlett, who gave a spirited talk in favor of prohibition.

Portland Sections N. E. L. A. and A. I. E. E.

The first regular meeting will take place Tuesday, October 10, 1916. The programme and entertainment has not been arranged.

The officers for the ensuing year are as follows:

N. E. L. A.—J. C. Henkle, chairman; E. F. Whitney, vice-chairman; C. L. Wernicke, treasurer; H. H. Schoolfield, secretary; executive committee, O. B. Coldwell, A. S. Moody, B. C. Condit.

A. I. E. E.—L. T. Merwin, chairman; J. C. Martin, secretary; executive committee, Paul Lebenbaum, A. S. Moody, E. D. Searing.

Programme and Papers Committee for Joint Meetings—E. D. Searing, chairman, O. C. Brill, R. S. Monges, J. F. Rockwood.

Entertainment Committee—J. P. Grodon, chairman, C. R. Young, C. P. Osborne, R. M. Boykin.

Luncheon Committee—A. S. Moody, chairman, F. O. Broili, E. H. Le Tourneo, W. D. Scott.

Membership Committee—A. C. MacMicken, chairman, Geo. G. Bowen, A. M. Sherwood, Jr., G. P. Mock.

Washington Association of Electrical Contractors and Dealers.

The first annual convention of the Washington Association of Electrical Contractors and Dealers at the Butler Hotel, September 19th. The meeting was opened by an address of welcome by the president, V. S. McKenny, who welcomed the contractors and visitors present and asked that they make themselves at home and enjoy themselves. J. J. Agutter, vice-president of the Washington Association, read a fine paper entitled, "The Washington Association, its History, Purpose and Aims." C. C. Hillis president of the Pacific Coast Jobbers' Association, read a paper on "Co-operation and Education," briefly abstracted as follows:

The gist of Mr. Hillis' argument was that co-operation is education. Business men realize that they can accomplish more for themselves by cultivating the acquaintance of their competitors than by fighting them. The problems of the industry can be solved by team work. The greatest benefit derived from association effort is in its educational features and in creating confidence. "To be a true co-operator, when you will not only have confidence in your competitors, but they

Washington Association of Electrical Contractors & Dealers Annual Convention
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Group of Those Attending First Annual Convention Washington Association of Electrical Contractors and Dealers.

will have confidence in you, takes time. Yet as a result, the many hours given to your business each day will produce not only greater material returns, but many pleasant thoughts of the men who have labored for the same end, and yet are your competitors."

P. J. Aaron of the Fobes Supply Company submitted a paper on Trade Acceptances which will be printed next week in these columns.

N. W. Graham of Los Angeles and W. S. Berry of San Francisco told what the contractors' association has accomplished for the electrical industry from the jobber's standpoint. F. J. Somers, president of the California association, spoke of what the contractors' association has accomplished for the electrical industry from the contractors' standpoint, and Albert H. Elliott, secretary of the Pacific Coast Electrical Jobbers' Association gave a fine address on the need of cooperation, education and confidence in the electrical industry.

In the afternoon a large volume of business was transacted, including a resolution, unanimously adopted, that the association indorse and assist "America's Electrical Week" to be conducted by the Society of Electrical Development.

The matter of the forming of a Western Conference Board with representatives from the coast states was approved and the rules governing same were adopted. Several changes in the constitution and by-laws were submitted and accepted.

The election of officers resulted as follows: President, V. S. McKenny (re-elected); vice-presidents; Seattle District, J. J. Agutter, W. M. Meacham and S. G. Hepler; Tacoma District, C. A. Young; Spokane District, Hugh L. Tinling and W. E. Chase; for North Yakima, H. H. Gladston, and for Bellingham, Mr. Clark. The forming af a district for Walla Walla was referred to the executive committee.

In the evening a banquet was held with 79 persons present, the principal speaker of the evening being Albert H. Elliott of San Francisco, whose address was greatly appreciated by all who heard it and greatly impressed them of the movement of association work. Five minute talks were made by H. J. Gille of Seattle, W. M. Meacham and Hepler of Seattle; Secretary Allison of the Washington Association; J. W. Oberender of the Oregon Association; Harry Sroufe of Portland; F. J. Somers of San Jose and Mr. Reese of Victoria, B. C. Throughout the banquet there was rendered a musical and vocal program and all present were greatly entertained. Mr. V. S. McKenny acted as toastmaster, and left nothing to be desired for entertainment and good fellowship. September 20th was taken up in an exceptionally fine auto trip to the summit of the Cascade Mountains and a fine chicken dinner was enjoyed at the Summit Inn.

Those attending the convention were:

A. M. Asselatine, Metropolitan Electric Co., Seattle.
Chas. L. Moses, Metropolitan Electric Co., Seattle.
C. A. Norton, Westinghouse Lamp Co., Seattle.
C. V. Aspinwall, Westinghouse Lamp Co., Seattle.
C. P. Stewart, Westinghouse Lamp Co., Seattle.
R. W. Clark, Puget Sound Trac., Light & Power Co., Seattle.
H. J. Gille, Puget Sound Trac., Light & Power Co., Seattle.
R. Muffley, Puget Sound Trac., Light & Power Co., Seattle.
J. R. Juvett, Stewart Electric Co., Seattle.
J. F. NePage, NePage, McKenny Co., Seattle
V. S. McKenny, NePage-McKenny Co., Seattle.
S. A. Sizer, NePage, McKenny Co., Seattle.
C. A. Martin, Pacific States Electric Co., Seattle.
F. J. Zorn, Pacific States Electric Co., Seattle.
A. S. Moody, Pacific States Electric Co., Portland.
T. E. Bibbins, Pacific States Electric Co., San Francisco.
H. J. Woodward, Pacific States Electric Co., Seattle.
Roy Worth, Pacific States Electric Co., Seattle.
J. I. Colwell, Western Electric Co., Seattle.
F. N. Cooley, Western Electric Co., Seattle.
John F. Ryan, Western Electric Company, Portland.
W. S. Berry, Western Electric Co., San Francisco.
L. L. Brown, Western Electric Co., Seattle.
James Kelly, Western Electric Co., Seattle.
W. E. Peters, Western Electric Co., Seattle.
J. J. O'Reilly, Western Electric Company, Seattle.
P. J. Aaron, Fobes Supply Co., Seattle.
Frank Parrish, Fobes Supply Co., Seattle.
H. B. Harris, Fobes Supply Co., Seattle.
P. J. Avord, Fobes Supply Co., Seattle.
H. E. Barley, Fobes Supply Co., Seattle.
Harry Byers, North Coast Electric Co., Seattle.
Arthur Hein, North Coast Electric Co., Seattle.
J. G. Parkhurst, Tacoma Electric Fixture Co., Tacoma.
J. E. Foss, Foss Electric Co., Bremerton.
A. E. Griswold, A. G. Griswold Elec. & Mfg. Co., Seattle.
H. H. Hoxie, Electric Ry. & Mfrs., Supply Co., San Francisco.
Roy E. Young, Contractor, Seattle.
S. B. Gregory, Arrow Electric Co., San Francisco.
George T. Bryant, North Coast Electric Co., Seattle.
J. J. Agutter, J. J. Agutter Company, Seattle.
D. J. Metcalf, Queen Ann Electric Shop, Seattle.
Chas. Burrett, Contractor, Spokane.
I. P. Mosso, Contractor, Spokane.
C. A. Duncan, Duncan Electric Co., Spokane.
Hugh L. Tinling, Hulton & Tinling Electric Co., Spokane.
A. F. Cook, Inland Electric Co., Spokane.
Mahlon McCain, Austin & McCain, Spokane.
Brewster Hall, Pass & Seymour, San Francisco.
S. G. Hepler, Arrow Electric Company, Seattle.
W. M. Meacham, Meacham & Babcock, Seattle.
H. D. Allison, Secretary Washington Association, Seattle.
Herbert C. Mess, A. H. Cox & Co., Seattle.
C. H. E. Williams, Contractor, Seattle
T. B. Bennett, Contractor, Seattle.
F. W. Rust, Ranier Electric Co., Seattle.
J. H. Reardon, Reardon Electric Co., Seattle.
Geo. B. Cooley, Buxbaum & Cooley, Seattle.
Rush McGargar, Ally Electric Shop, Seattle.
H. A. Wilson, Contractor, Seattle.
M. L. McMurtrey, Electric Supply & Fixture Co., Walla Walla.
G. R. Labberton, Contractor, North Yakima.
C. K. Bogart, Electric Maintenance Co., Vancouver, B. C.
H. W. Rankin, Rankin & Cherrill, Spokane.
J. W. Oberender, Secretary Oregon Association, Portland.
Harry Sroufe, NePage, McKenny Co., Portland.
F. J. Somers, Century Electric Co., San Jose.
Harry D. Reese, Carter Electric Co., Victoria, B. C.
R. B. Wiseman, Electric Supply & Fixture Co., Ellensburg.
Albert H. Elliott, Secretary Jobbers' Association, San Francisco.
J. O. Lushington, Lushington Electric Co., Seattle.
F. B. Lushington, Lushington Electric Co., Seattle.
L. Schaffer, J. J. Agutter Co., Seattle.
Robert E Curtis, Curtis Electric Co., Seattle.
T. N. Bristow, H. B. Squires Co., Seattle
L. D. Spencer, Contractor, Seattle.
J. G. Maitland, Maitland Elec. Eng. Co., Seattle.
R. K. LeGrand, Electric Fixture Co., Seattle
C. H. Birkel, Birkel Eng. Co., Seattle.
E. C. Leighton, Leighton Eng. Co., Seattle.
F. R. Beattie, Contractor, Seattle.
F. G. Larkin, Telephone Equipment Co., Seattle.
F. T. Richards, Contractor, Seattle.
C. C. Hillis, Electric Appliance Co., San Francisco.
H. E. Sanderson, Bryant Electric Co., San Francisco.
N. W. Graham, Holabird-Reynolds Co., Los Angeles.
F. E. Smallidge, Electric Supply Co., Wenatchee.
W. E. Chase, Chase Electric Co., Spokane.
F. J. Curran, Curran Sign Co., Spokane.
P. D. Depeyter, Power City Electric Co., Spokane.
C. A. Slelark, Clark Electric Co., Bellingham.
F. P. O'Donnell, F. P. O'Donnell & Co., Seattle.

NEWS NOTES

ILLUMINATION.

FORT BIDWELL, CAL.—The board of supervisors will receive bids up to October 2 for installing lights in the Bidwell Lighting District.

FULLERTON, CAL.—Plans to illuminate the streets of the city with ornamental lighting posts have been temporarily dropped by the city council.

VISALIA, CAL.—Trustees Gibson and Young have been instructed to investigate the cost and other details of an adequate electrolier lighting system for the business district.

PALO ALTO, CAL.—The city council is taking steps to call a bond election to provide funds for the purchase by the city of the distributing system and storage tanks of the Palo Alto Gas Company, valued at $65,000.

LOS ANGELES, CAL.—A contract has been awarded by the board of supervisors to the California-Arizona Construction Company for concrete lighting posts on W. Adams street in Bon Meadows at a cost of $21,539.

LOS ANGELES, CAL.—Petitions for additional lights in the Verdugo and Lankershim Lighting Districts have been granted by the board of supervisors and the city engineer has been requested to prepare specifications.

FORT BIDWELL, CAL.—W. D. Hill and I. H. Skillman have taken out a certificate to furnish light and power to Bidwell West, Bidwell East and Lake City precincts of Modoc County, under the name of the Bidwell Electric Company.

IDAHO FALLS, IDAHO.—An ordinance has been passed by the council granting Wm. D. Wilcox the right to construct pipe lines through the streets of Idaho Falls, for the purpose of conveying artificial gas, the franchise to run 50 years.

TEMPE, ARIZ.—The construction of a lighting plant is being considered by the council. The cost of the work is estimated at $26 000. The purchase of the present holdings of the South Side Gas & Electric Company is also being considered.

BOISE, IDAHO.—A hearing will be held at Wallace by the commissioners, October 9, on the application of the Robertsinskip Plumbing & Heating Company for a certificate of public convenience and necessity for a heating and lighting plant they wish to build in Wallace.

TRANSMISSION.

FRESNO, CAL.—At present there are about 300 men at work in the vicinity of Huntington Lake and Cascade preparing for the construction work that will further develop the Big Creek project.

RIVERSIDE, CAL.—The City Electric Supply Company of this city has secured the contract for electric transmission lines, telephone lines and substation work on the Lindsay-Strathmore irrigation project, on its bid of $31,000.

BELLINGHAM, WASH.—The construction of a new power plant above Marblemount on the Skagit River is indicated by the filing of three water power rights by G. M. U. Tait of Seattle, permitting him to divert 15,000 cu. ft. of water per second from three various places in the course of the Skagit River in Whatcom County. The purpose of the plant is to furnish electric power to railways, manufacturing concerns, etc.

TRANSPORTATION.

MARYSVILLE, CAL.—The Los Verjels Land & Water Company is planning to install an electric road from Bangor to connect with the Northern Electric at Oroville.

SAN FRANCISCO, CAL.—The public utilities committee of the board of supervisors will shortly take up the question of building an extension to the municipal street railway down Baker street to the Palace of Fine Arts and the proposed new State Normal School in the California building.

STOCKTON, CAL.—A movement has been instituted by the Stockton labor union bodies for the purchase by the city of the street car lines of the Stockton Electric Railroad Company. Communications were received from the Central Labor Council, the San Joaquin County Building Trades Council, the Stockton Improvement Club and the South Stockton Improvement Club and filed with the council requesting that consideration be given the matter of purchasing the street railroad. In each case resolutions adopted by the bodies were inclosed, the resolutions being identical.

IRRIGATION.

FAIRPLAY, CAL.—After a trial of the irrigation ditch of the Howard-Haywards-Lane interests the residents of Fairplay have decided to take steps to form an irrigation district and take over the ditch from the company.

FRESNO, CAL.—Representatives of Miller & Lux conferred with a committee of farmers of the Madera county plains over the project to irrigate more than 400,000 acres of land by a vast system of storage dams, supplied by the San Jcaquin River.

MONTAGUE, CAL.—The Big Springs district has been the center of activity in the Shasta Valley during the summer and the project is rapidly nearing completion. The large centrifugal pump has been installed for several weeks and has been running constantly.

OROVILLE, CAL.—The Western Canal Company has a crew of surveyors at work running lines from the present terminus of the ditch in the Dodge rice plantation to the Sacramento River near Butte City. It is understood that a number of Butte City landowners are anxious to secure water from the ditch.

SUSANVILLE, CAL.—Petitions are on file asking the supervisors of Lassen County to call elections for the organization of two more districts. One of the proposed districts will furnish water to 7000 acres in the Janesville section and the other, known as the Southern Lassen District, will irrigate about 35,000 acres in Long Valley.

MODESTO, CAL.—A resolution providing for the calling of an election in compliance with petitions filed several weeks ago for the purpose of forming a public utilities district including the territory in the Modesto and Turlock Irrigation districts was passed at a special meeting of the county board of supervisors. The date for the election was left for future determination.

TELEPHONE AND TELEGRAPH.

TUCSON, ARIZ.—It is stated that Tucson will have a complete new Western Union Telegraph Company station shortly.

OROVILLE, CAL.—The local wires of the Western Union Telegraph Company may be placed underground. This would cost about $2500.

GLOBE, ARIZ.—Plans are being perfected for the betterment and extension of the telegraph service of the Western Union Company in this district.

SAN BERNARDINO, CAL.—The Home Telephone Company has now in proces of completion the placing of underground cables within the business district. The switchboard is also to be improved. The equipment, together with underground work represents an outlay of approximately $25 000.

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Rosettes.	List.	Sell.
Porcelain, 3¼-inch Box	.15	.15
Porcelain, 4-inch Box	.20	.20
Porcelain, with Clips, 3¼-inch Box	.25	.25
Porcelain, with Clips, 4-inch Box	.20	.30
Brass Shell, 3¼x4-inch	1.00	1.00
Cleat Rosettes, each	.20	.20
Concealed Rosettes, each	.20	.20
Moulding Rosettes, each	.20	.20
Slate (Black).		
10x 9x ⅞	.55	.55
12x10x ⅞	.75	.75
14x10x ⅞	.85	.85
12x12x ⅞	.95	.95
14x14x ⅞	1.40	1.40
16x12x ⅞	1.30	1.30
16x16x ⅞	1.85	1.85
18x12x ⅞	1.60	1.60
18x14x ⅞	1.75	1.75
18x17x ⅞	2.05	2.05
18x18x ⅞	2.35	2.35
19x18x ⅞	2.50	2.50
22x18x ⅞	2.75	2.75
24x18x ⅞	3.25	3.25
25x18x ⅞	3.35	3.35
27x18x ⅞	3.60	3.60
30x18x ⅞	4.05	4.05
33x18x ⅞	4.35	4.35
36x18x ⅞	4.85	4.85
38x18x ⅞	5.50	5.50
41x18x ⅞	5.80	5.80
43x18x ⅞	6.10	6.10
48x18x ⅞	6.70	6.70
51x18x ⅞	7.25	7.25
53x18x ⅞	7.65	7.65
56x18x ⅞	7.90	7.90
30x24x ⅞	5.30	5.30
60x30x1½	22.05	22.05
48x30x1¼	15.95	15.95
60x18x1½	13.00	13.00
½-in. x 3-in. Linings for above sizes, per Lineal Foot	.40	.40
Rheostat Drilling, per Hole	.08	.08
Sockets—Brass Shell.		
Key Socket, ⅛-inch	.33	.30
Key Socket, ⅜-inch	.39	.35
Key Socket, Pendant	.33	.25
Keyless Socket, Pendant	.33	.30
Keyless Socket, ⅛-inch	.30	.25
Keyless Socket, ⅜-inch	.36	.30
Keyless Socket, ⅝-inch, Male Thread	.39	.35
Pull Socket ⅛-inch	.60	.60
Pull Socket, ⅜-inch	.66	.65

The correctness of these suggested selling prices is not guaranteed by publisher. Suggestions for corrections are invited.

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Sockets—Brass Shell—(Continued.)	List.	Sell.
Mogul, Without Shade Holder	1.00	1.00
Mogul, With Shade Holder	1.30	1.30
Twin Keyless, ⅜-inch	.70	.70
Twin Pull Chain, ⅜-inch	1.06	1.25
Twin Keyless Extension	1.00	1.00
Angle, ⅛-inch	.35	.35
Angle, ⅜-inch	.41	.45
Sockets—Wall.		
Key, Brass Shell	.44	.45
Keyless, Brass Shell	.40	.40
Keyless, Porcelain Base	.40	.40
Key, Porcelain Base	.44	.45
Pull Socket, Porcelain Base	.70	.75
Key Angle, Porcelain Base	.55	.55
Keyless Angle, Porcelain Base	.50	.50
Pull Angle, Porcelain Base	.70	.75
Mogul, P. & S., No. 520	1.00	1.00
Sockets—Porcelain.		
Key Pendant Socket	.30	.30
Keyless Pendant Socket	.25	.25
Key Socket, ⅛-inch	.35	.35
Key Socket, ⅜-inch	.35	.35
Keyless Socket, ⅛-inch	.30	.30
Keyless Socket, ⅜-inch	.30	.30
Mogul	1.00	1.00
Pull Chain, ⅛-inch	.85	.85
Pull Chain, ⅜-inch	.85	.85
Sockets—Weatherproof.		
Porcelain	.12½	.20
Composition	.24	.25
Hard Rubber	1.00	.75
Sockets—Miniature and Candelabra.		
Keyless	.23	.25
Pull Chain	.60	.60
Key	.33	.35
Porcelain	.07½	.15
Weatherproof	.12	.15
Sockets—Decorative Lighting.		
Porcelain, Temporary	.24	.24
Mica, Temporary	.30	.30
Cleat, Temporary	.18	.20
Solder.		
Solder, per lb.	.50	.60
Solder Paste, per 2 oz. can	.15	.25
Solder Sticks, each	.40	.25

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ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

A-1 **American Ever-Ready Works of National Carbon Co**
Los Angeles; 755 Folsom St., San Francisco; Seattle.

B-1 **Baker-Joslyn Company** 3
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

I-1 **Benjamin Electric Manufacturing Co** .....
590 Howard St., San Francisco.

C-1 **Century Electric Co** 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 **Crocker-Wheeler Co** 3
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 **Cutler-Hammer Manufacturing Co** 5
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 **Davis Slate & Manufacturing Co** 3
Chicago, Ill.

D-2 **Dearborn Chemical Company** 11
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-1 **Edison Lamp Works of General Electric Co** .....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 **Edison Storage Battery Co** 11
206-8-10 First St., (near Howard), San Francisco.

E-3 **Electric Agencies Co** .....
279-283 Minna St., San Francisco; 419-421 E. Third St., Los Angeles.

E-4 **Electric Storage Battery Co** .....
743 Rialto Bldg., San Francisco.

E-5 **Electric Railway & Manufacturing Supply Co** 11
34 Second St., San Francisco.

E-6 **Electric Novelty Works** .....
533 Mission St., San Francisco.

E-7 **Economy Fuse & Mfg. Co** 12
Kinzie and Orleans Sts., Chicago.

F-3 **Federal Sign System (Electric)** .....
618 Mission St., San Francisco.

G-1 **General Electric Co** 10
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

H-1 **Habirshaw Electric Cable Co., Inc** .....
(See Western Electric Company.)

H-2 **Hemingray Glass Co** 11
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-3 **Haller-Cunningham Electric Co** 11
428 Market St., San Francisco.

H-7 **Hurley Machine Co** 2
New York and Chicago. (See Pacific States Electric Co.)

I-2 **Illinois Electric Co** .....
261-263 So. Los Angeles St., Los Angeles.

I-3 **Interstate Electric Novelty Co** .....
111 New Montgomery St., San Francisco.

L-1 **Leahy Manufacturing Co** 4
Eighth and Alameda St., Los Angeles.

L-2 **Locke Insulator Manufacturing Co** 4
(See Pierson, Roeding & Co.)

M-2 **McGlauflin Manufacturing Co** 4
San Rafael, Cal.

M-3 **Moore & Co., Charles C** 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

M-4 **Morse Chain Company** .....
Monadnock Bldg., San Francisco.

N-1 **Nason & Co., R. N** .....
151 Potrero Ave., San Francisco.

N-2 **National Conduit & Cable Co., The** .....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 **National Lamp Works of G. E. Co** .....
(All Jobbers.)

N-4 **New York Insulated Wire Co** .....
629 Howard St., San Francisco.

N-6 **National Carbon Co** .....
Cleveland, Ohio.

O-1 **Okonite Co. (The)** 12
(All Jobbers.)

P-2 **Pacific States Electric Co** 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-4 **Pelton Water Wheel Co** 11
2219 Harrison St., San Francisco.

P-5 **Pierson, Roeding & Co** 4
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-7 **Pittsburgh Piping & Equipment Co** 12
Monadnock Bldg., San Francisco.

S-1 **Schaw-Batcher Company, Pipe Works, The** .....
211 J St., Sacramento; 356 Market St., San Francisco.

S-4 **Southern Pacific Co** 4
Flood Bldg., San Francisco.

S-5 **Sprague Electric Works** 12
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 **Standard Underground Cable Co** .....
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815 Newhouse Bldg., Salt Lake City, Utah.

T-1 **Thomas & Co., R** .....
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 **Tubular Woven Fabric Company** .....
Pawtucket, R. I.

U-1 **United Sheet Metal Works** .....
575 Howard St., San Francisco.

W-1 **Wagner Electric Manufacturing Company** 12
St. Louis, Mo.

W-2 **Western Electric Co** .....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-3 **Ward-Leonard Electric Co** 12
Mt. Vernon, New York.

W-4 **Westinghouse Electric & Manufacturing Co** 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-6 **Westinghouse Lamp Co** .....
(See Westinghouse Electric & Manufacturing Co.)

W-8 **Western Pipe & Steel Co** .....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles.